Precise control of operating load temperature is a key requirement for application of a large scale helium refrigerator. Strict control logic and time sequence are necessary in the process related to main components including a control load, turbine expander and compressors. However control process sequence may become disordered due to improper PID parameter settings and logic equations and causes temperature oscillation, load augmentation or protection of the compressors and cryogenic valve function failure etc. Combination of experimental studies and simulation models, effect of PID parameters adjustment on the control process is present in detail. The methods and rules of general parameter settings are revealed and the suitable control logic equations are derived for temperature stabilization.

The main temperature adjust components

- Turbine expander: speed 12krpm, efficiency over 70%
- Auxiliary heater: leakage rate 10⁻⁹Pam³/s

Further resolves of the temperature precise control by studying:
- Dynamic response characteristics of the control load itself will be identified by model buildup and experimental measurement
- PID parameters are going to be set according to its response
- Revise and validation of the related logic equations

While virtual load power decreases gradually, the TE speed should drop down firstly, and then the compressor speed should decrease. Actually, the compressor speed increases firstly due to improper PID control and control equations etc.